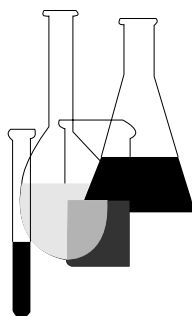




Spray Drift Test Guidelines

OPPTS 840.1200 Spray Drift Field Deposition



INTRODUCTION

This guideline is one of a series of test guidelines that have been developed by the Office of Prevention, Pesticides and Toxic Substances, United States Environmental Protection Agency for use in the testing of pesticides and toxic substances, and the development of test data that must be submitted by the Agency for review under Federal regulations.

The Office of Prevention, Pesticides and Toxic Substances (OPPTS) has developed this guideline through a process of harmonization that blended the testing guidance and requirements that existed in the Office of Pollution Prevention and Toxics (OPPT) and appeared in Title 40, Chapter I, Subchapter R of the Code of Federal Regulations (CFR), the Office of Pesticide Programs (OPP) which appeared in publications of the National Technical Information Service (NTIS) and the guidelines published by the Organization for Economic Cooperation and Development (OECD).

The purpose of harmonizing these guidelines into a single set of OPPTS guidelines is to minimize variations among the testing procedures that must be performed to meet the data requirements of the U. S. Environmental Protection Agency under the Toxic Substances Control Act (15 U.S.C. 2601) and the Federal Insecticide, Fungicide and Rodenticide Act (7 U.S.C. 136, *et seq.*).

Final Guideline Release: This guideline is available from the U.S. Government Printing Office, Washington, DC 20402 on *The Federal Bulletin Board*. By modem dial 202-512-1387, telnet and ftp: fedbbs.access.gpo.gov (IP 162.140.64.19), or call 202-512-0132 for disks or paper copies. This guideline is also available electronically in ASCII and PDF (portable document format) from the EPA's World Wide Web site (<http://www.epa.gov/epahome/research.htm>) under the heading "Researchers and Scientists/Test Methods and Guidelines/OPPTS Harmonized Test Guidelines."

OPPTS 840.1200 Spray drift field deposition.

(a) **Scope**—(1) **Applicability.** This guideline is intended to meet testing requirements of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. 136, *et seq.*).

(2) **Background.** The source material used in developing this harmonized OPPTS test guideline is OPP guideline 202-1—Drift field evaluation (Pesticide Assessment Guidelines, Subdivision R: Pesticide Spray Drift Evaluation, EPA Report 540/9-84-002, April 1984).

(b) **General**—(1) **Purpose.** Drift field deposition studies are performed to determine the influence of a number of equipment and formulation parameters and environmental factors on the dispersal of the formulated pesticide from the application equipment to the intended surface(s). The major parameters that will be tested are type(s) of nozzle, orientation to the wind shear, formulations, cross-wind velocity and evaporative factors. Drift field evaluation involves commercial equipment to determine the extent of drift expressed as concentration vs. distance. These normally are measured under so-called worse case equipment and environmental conditions.

(2) **Test standards.** In addition to the test standards set forth in OPPTS 840.1000, the following test standards apply:

(i) **Test substance**—(A) **End-use product.** A formulated end-use product of the same formulation category as the end-use product to be registered, i.e. wettable powders, emulsifiable concentrates, etc., and use, i.e. herbicide, insecticide, etc., will be tested. Use of dyes or other indicators with the pesticide are acceptable only if these materials do not interfere with chemical analysis or bioresponse, do not alter chemical or physical properties of the diluted spray, do deposit in direct proportion to concentrations of active ingredients, and do remain stable until analysis.

(B) **Tank mixes and package mixes.** Drift data requirements for each package mix, and for each tank mix allowed in labeling are identical to those requirements for any single pesticide applied alone, i.e the droplet spectrum and swath displacement should be evaluated. Alternatively, the swath displacement data for the mixture may not be required if the mixture activity spectrum, droplet size spectrum, and physical data are sufficiently similar to such data characterizing the mixture's most phytotoxic single component for which acceptable swath displacement data have been submitted.

(ii) **Dosage levels.** Maximum label-recommended pesticide dosages should be evaluated in all spray drift field evaluations.

(iii) **Study location.** The site should be typical in geography, topography, season, and meteorology of those sites within intended use patterns. The use of two or more topographically and meteorologically diverse sites

is recommended in order to ascertain the effects of these variables on spray drift. The evaluation should preferably be performed in a field or fields having foliage or crop cover conditions similar to actual use conditions. Open fields (not runways) may be acceptable only for evaluation of pesticides to be applied directly to soil or to just-emerging plants. If it is felt that barren fields should be used to test a product where vegetation would exist according to the label recommendations, the justification should be submitted to indicate the reason for this test modification.

(iv) **Collection surface placement.** (A) Collection surfaces for fallout sampling should be located:

(1) Within the target area, at least one swath width upwind, and at known distances outside the target area downwind to a minimum of 1,000 ft (300 m) for aerial and air carrier applications and 500 ft (150 m) for other ground applications (including sprinkler irrigation systems).

(2) In a straight line approximately parallel to a stable wind direction and as close as possible to the perpendicular of and centered to the direction of travel for the application equipment.

(3) At the soil surface or, if vegetation is present, at a level which corresponds to the height of the surrounding canopy.

(B) Air samplers, such as a high volume type (20–50 ft³/min), should be placed at a 2– to 3–m height at at least three down wind collection stations (for example, at 200, 600, and 1,000 ft (60, 80, and 300 m) downwind) to sample airborne particles of the chemical. The filters on the air samplers should be changed frequently in order to minimize stripping of pesticide from the filter.

(C) While lateral distances between collection stations are left to the discretion of the applicant, it is important that a sufficient number of collection stations be established to present a definitive uninterrupted picture of deposits across the treated swath as well as outside the target area. Location of collection stations is particularly critical in areas where deposition rates are expected to change rapidly over a small lateral distance.

(v) **Protocols.** (A) Spray drift evaluation data from one or more applications to a single swath line are acceptable. Multiple applications (passes) to a single swath are preferred. Full-field applications can be made. When bioassays are used in the swath displacement test, multiple passes over the same swath may be made only if the bioassay organisms are no closer than one swath width downwind. The length of the treated swath should be such that the spray cloud, if extended, would pass over the most distant downwind collection devices, taking into account the probability that wind direction may not coincide perfectly with the line of collection points. Normally the spray line should equal the sampling line length, that is, the

spraying line should be 1,000 ft in length if the downwind sampling line is 1,000 ft.

(B) At least one study should be conducted using equipment, equipment adjustment and operation, procedures, and conditions most conducive to drift as would be allowed in labeling, and as determined in part from droplet spectrum tests. As an example, evaluate the spray drift using the following parameters that would be permitted in normal application practices: Maximum recommended nozzle height (from the ground), nozzle pressure, crosswind velocity, temperature gradient at the canopy and 2 m above it, ground speed of the equipment, pesticide dosage, and airstream shear force (nozzle discharge orientation to air stream); minimum recommended nozzle orifice diameter, spray volume, and relative humidity; and using cores or any other devices to increase droplet dispersion or produce sheets, fans, or cones.

(c) **Data reporting.** The registrant's report on spray drift field deposition should include all information necessary to provide: A complete and accurate description of the treatments and procedures; sampling data; data on storage of the samples until analysis (if performed); any chemical analysis of the collection surfaces as to chemical content (if performed); recovery efficiency; reporting of the data, rating system and statistical analysis; and quality control measures/precautions taken to ensure the fidelity of the operations. Specifically, each report should include the following information:

(1) **General.** (i) Cooperator or researcher (name and address), test location (county and state; country, if outside of the U.S.A.), and date of study.

(ii) Name (and signature), title, organization, address and telephone number of persons responsible for planning/supervising/monitoring.

(iii) Trial identification number.

(iv) Quality assurance indicating: control measures/precautions followed to ensure the fidelity of the droplet size; record-keeping procedures and availability of logbooks; skill of the laboratory personnel; equipment status of the laboratory; degree of adherence to good laboratory practices; and degree of adherence to good agricultural practices for application of pesticides.

(v) Other information the registrant considers appropriate and relevant to provide a complete and thorough description of the test procedure and results.

(2) **Control data.** Control values for the test should be reported. Due to the wide diversity of pesticide properties, use patterns, and organisms exposed in the field environment, specific reporting requirements for con-

trol values (as to source, sampling regime, and total number of sample data submitted) will depend upon the complexity and variability of the environment in which the test is to be conducted.

(3) **Test substance and physical properties.** (i) Identification of the pesticide active ingredient including chemical name, common name (ANSI, BSI, ISO, WSSA), and company developmental/experimental name.

(ii) Active ingredient percentage by weight in the formulated end-use product used or substituted (with reasons for substitution of end-use product).

(iii) Type of formulation (e.g., emulsifiable concentrate, flowable powder, liquid, etc.). Product formulation used, diluent and manner of dilution, mixtures, adjuvants, and their physical properties (surface tension, viscosity, density, vapor pressure, etc.).

(iv) Dosage of active ingredients or acid equivalent per unit area of land or gallons-per-minute (gpm) or liters-per-minute (lpm). The concentration of the final diluted spray mixture (in the spray tank) should be sampled, chemically analyzed, and reported.

(v) If droplet size distribution is determined during the field evaluation, physical property data, including droplet size, viscosity, density, vapor pressure, visco-elasticity, and surface tension, should be determined and reported.

(4) **Test method.** Each report should contain a statement regarding the test method used with a full description of the experimental design and procedure and including.

(i) Identification of the use of dyes or other indicators.

(ii) Identification of adjuvants used and other tank mix pesticides.

(5) **Collection surfaces.** (i) Identification of the collection surfaces. The collection surfaces may include collection cards (flat horizontal or vertical surfaces), air samplers or other devices by which droplet size distribution can be measured as necessary, and the down-wind pesticide movement can be quantified.

(ii) Identification of the number of replicates.

(iii) Identification of the placement of the collection surfaces with respect to the vegetation canopy or other anticipated surfaces, treated area, and wind direction.

(6) **Site of the test.** (i) Site description of the drift field evaluation such as type of forest, field, or grove.

(ii) Climatological data (records of applicable conditions for the type of site, i.e, temperature, air thermoperiod, rainfall or watering regime, photoperiod, air velocity and wind direction, relative humidity).

(iii) Field layout (graphic display is encouraged).

(7) **Application equipment.** (i) The nozzle type, orifice size, and core identification.

(ii) The nozzle pressure and flow rate.

(iii) The nozzle discharge orientation to the airstream. Nozzle discharge orientation should be designated in degrees related to the direction of travel of the spray equipment. Zero degrees indicates a horizontal nozzle discharge pointing rearward (opposite to the equipment direction of travel), 90° indicates a vertical nozzle discharge pointing downward, and 180° indicates a horizontal nozzle discharge pointing forward (with the equipment direction of travel).

(iv) The estimated minimum and maximum nozzle-to-target height.

(v) Air velocity past the nozzle.

(vi) Descriptions of techniques and size determination devices.

(vii) Particle size distribution vs. cumulative percent volume and particle size distribution vs. droplet number (frequency) (an attempt should be made to determine the droplet size distribution where droplet formation is finalized).

(8) **Additional information.** If droplet size distribution is determined during the field evaluation, the following information should also be submitted:

(i) A diagram of the plot indicating north, swath width, and orientation, and location and spacing of the collection stations.

(ii) Temperature at two levels, wind velocity and direction, variations in velocity and direction during the application, relative humidity, atmospheric pressure, and air stability. The latter is expressed as Barad's stability ratio:

$$SR = [(T_3 \text{ meters} - T_1 \text{ meters})/(\text{ave. wind velocity})^2] \times 10^5$$

Temperature should be determined just above the canopy (T_1) and at least 2 m above that (T_3) for all applications. A standard vertical separation should be 2 m. Wind velocity should be determined at least 1 to 2 m above the canopy height.

(iii) Spray volume (liters per hectare or gallons per acre) and carrier(s). The maximum and minimum carrier volumes recommended on the label should be reported.

(iv) The ground speed of application equipment, the number of swaths sprayed during exposure of collecting surfaces, and swath width.

(v) The quantity of active ingredients(s) or acid equivalent collected or detected at each sampling point in terms of kilograms per hectare (pounds per acre).

(vi) Adjuvant identification and dilution used.

(vii) The estimated minimum and maximum nozzle-to-target height.

(viii) Where droplet size distribution is determined during the field evaluation, refer to OPPTS 840.1100 for the reporting requirements.

(9) **Results.** The quantity of active ingredients or acid equivalent collected or detected at each sampling point in terms of kilograms per hectare (or pounds per acre).

(10) **Evaluation.** The overall movement of the pesticide formulation as a result of aerial transport.

(d) **Exposure assessment.** Employing the field evaluation data provided in paragraph (c) of this guideline, the registrant should make an exposure assessment with respect to the quantity of pesticide to which nontarget organisms including humans may be exposed. Comparison of the toxicity data from studies conducted for plants, animals, or humans to the exposure that may occur may be made as a part of an overall risk assessment for nontarget organisms and humans. The assessment should apply primarily to the nontarget areas adjacent to the intended application sites.